IT LABOUR MARKET ASSESSMENT:

A REVIEW OF AVAILABLE INFORMATION

Research Report No 71

July 1998

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GHK Economics and Management

ISBN 0 85522 809 1

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SUMMARY

Introduction

To ensure increased productivity and economic wealth, the UK economy must fully exploit the benefits of Information Technology (IT). However, as ever more businesses and people are being exposed to IT, there is evidence that the UK faces a skills shortage which threatens our competitiveness. Unfortunately, the current state of Labour Market Information means there is a limited understanding as to the nature of any IT skills shortage: whether in terms of absolute numbers, trends, or the specific skill needs required in the future.

This report provides some insight into these issues by drawing together the limited information available and placing IT skills in a wider labour market context. A central theme of the report is the need for an holistic approach to IT human resources that focuses on core skills and deep IT knowledge, rather than transient, product specific skills, while also understanding the interactions between IT end-users, IT professionals and training providers.

IT And Economic And Business Competitiveness

- The IT sector is unique in terms of the speed at which new products, services and occupations are being developed or created. 60% of IT software is less than 2 years old. Penetration of the economy has been dramatic - IT is increasingly important to ever more businesses.

- However, IT is still at an early stage of evolution. Compared to the development of the motor industry, the Internet has yet to reach the sophistication of the Model T Ford. We are only just beginning to understand the impact of IT on business.

- Despite massive investment, the benefits of IT do not appear as strongly in the productivity figures as might be expected - there is a 'productivity paradox'. This could reflect a failure of official statistics to adequately capture the improvements that IT is delivering. It could also reflect a failure of businesses to *successfully exploit* IT.

IT Labour Market Estimates

- Existing UK statistics do not provide adequate information on the number of IT professionals - workers possessing IT skills beyond the basic applications knowledge of software packages. Estimates from various sources, and adopting various definitions, put the number at anything between 499,000 and 708,000.

- Projections for the future growth of IT professionals over 1996 to 2002, vary between 28% and 34%. In the 10 years to 2006, the US Bureau of Labour Statistics has made projected increases in the region of 100% for the main IT professional occupations.

- There are at least 13 million end-users of IT. By 2000, over 90% of the workforce is expected to interface with IT.

- The supply of IT qualified people from the education sector has increased. For example, in 1996/97, 9500 students graduated from Higher Education with a degree in computer sciences (14% up from 1994/95), 3200 obtained IT related postgraduate qualifications and 4200 'other HE qualifications'.

- The contribution of employers to the IT skills' base is difficult to ascertain. Surveys indicate that IT training is a high priority for many businesses. International comparisons suggest that the UK performs strongly in this respect.

Assessing IT Skill Shortages

- There is evidence of both IT skills shortages and skills gaps. Skills shortages arise when an employer is unable to recruit *new suitably skilled people*. Skills gaps refer to skills which *existing employees* do not possess and which hamper business growth.

- Tightening in the labour market for IT graduates, and various recruitment surveys indicate that there are IT skills *shortages*. Several business surveys also highlight IT skills *gaps* within businesses. Wage inflation for IT professionals suggest a further tightening of the labour market.

IT Skills - Key Issues And Trends

- It is important to differentiate between temporary problems, for example skill requirements for Year 2000 compliance, and more deep seated supply issues, such as a shortage of IT professionals with appropriate management and business skills.

- Increasingly there is a global labour market for IT skills. UK based IT companies can retain control of design and customer liaison, while tapping into a large pool of low-wage, expert programmers, for example in India, thus controlling their costs, while exploiting time zones to work a 24 -hour day. It makes no sense to tool-up UK workers with product specific programming skills to compete against this global labour pool. To ensure long term competitiveness, the UK must focus on those skills which create the most value, and are least susceptible to low-wage competition.

- For IT professionals, the *product specific* skills most highly sought are knowledge of: Unix, C/C++, Oracle, Visual Basic and Windows NT. More general skills, most in demand are knowledge of networking and operating systems.

- Predicting future demand for product specific skills is especially problematic. Demand can alter rapidly as new products come onto the market. For example, development of websites used to typically require knowledge of HTML (Hyper Text Markup Language), however the introduction of 'Microsoft Front Page' now enables people without HTML skills to develop websites.

- IT staff recruitment and turnover are problems for businesses, but many large companies have yet to develop retention strategies, beyond basic cash incentives or rewards. Many IT professionals who leave to become contractors, complain of an absence of proper career development structures.

- Small businesses typically require a basic level of IT service and support (especially maintenance), but do not have the in-house capability to supply it themselves. Those SMEs with IT departments, but running standard IT systems and applications experience difficulty retaining talented IT professionals, given the opportunities and challenges offered in larger departments or at 'leading edge' IT businesses.

- Communication between IT professionals and end-users remains inadequate. IT professionals must be equipped with the skills that will enable them to put IT within a wider business context, to successfully use IT as a strategic business tool and to communicate with non-professionals in a fashion that leads to the successful implementation of IT solutions.

- Many end-users lack basic IT literacy, but for younger labour market entrants this is less of a problem. However, younger workers are more likely to be lacking in general skills such as communication, literacy, and numeracy. In this sense, talk of a 'skills' revolution' is misleading - the deficits that need to be addressed relate to 'traditional' core skills.

- Solutions and policy recommendations should focus on the needs of different groups of users and the different *markets* for IT services. With regards markets for IT training, many large companies do not see the public sector as their training supplier of choice. They prefer to use private sector suppliers because they assume or believe that they have better quality staff and are more likely to be at the 'cutting edge'. In this context, even if the public sector were to offer similar courses at the same or lower cost, it is still unlikely that businesses would use them as a training provider.

Summary And Recommendations

- Improvements must be made to the quality of IT labour market data. Consistent definitions of IT professionals and accounting of these within SOC (Standard Occupational Classification) codes is essential if future assessments of supply and demand are to be more robust.

- A framework for assessing IT competencies and roles needs to be established - one that is easily understood and can cope with the dynamic pace of change within the Information Economy.

- Given that the IT sector is characterised by constant and rapid technological change, the most important skills are those which confer flexibility: i.e. basic aptitudes and a knowledge of IT fundamentals on which to build product and application specific skills.

- Trying to predict demand for *product specific* skills is extremely difficult. The public sector does not have the resources or the responsiveness to react to ever changing demands for skills in particular products, nor should it aim to.

- Public sector provision of IT skills should target areas where it can best make a successful contribution. A skill supply strategy must be based on a proper understanding of market segments and the role of different training and service suppliers. This must acknowledge which organisations are the training provider of choice for which types of businesses. It must also understand the limits of public sector provision. In this respect, SMEs could be a focus for policy development, given that they face several basic IT problems which are not adequately addressed by the private sector.

- The key role for the education sector is to provide a solid underpinning in the fundamentals of IT, allied to associated skills such as communication, business and project management.

- Although young people tend to be more IT literate, recruitment into the profession has been disappointing - there is a dearth of new, young entrants, and steps need to be taken to improve the profession's image and to successfully promote the IT profession as a career.

1. INTRODUCTION

To ensure increased productivity and rising living standards, the UK economy must fully exploit the benefits of Information Technology (IT). The spread of IT across an increasing range of economic activities and the rapid pace of technological change are fundamental dimensions of the 'Information Economy'. However, as ever more people are being exposed to these forces, there is concern that the UK faces an IT skills' shortage which threatens business competitiveness.

Unfortunately, the current state of Labour Market Information (LMI) means there is a limited understanding as to the nature of any skills' shortage: whether in terms of absolute numbers, trends, or specific skill needs that will be required in the future. However, this report aims to provide some insight into these issues by drawing together the limited information available and placing IT skills in a wider labour market context.

The analysis begins with the significance and impact of IT on the UK economy, before providing a broad outline of the demand and supply of skills to the labour market. This is followed by an assessment of skill shortages and concerns as reported in various industry surveys, and a discussion of the problems encountered in actually placing this data in a meaningful context that would form the basis for policy development.

A central theme of the report is the need for an holistic approach to IT human resources that looks at the interactions between IT users, professionals and training providers. This also acknowledges the fundamental importance of basic skills and aptitudes that are not unique to IT, but are vital to business competitiveness and the successful exploitation of IT.

2. THE SIGNIFICANCE OF IT TO ECONOMIC AND BUSINESS COMPETITIVENESS

2.1 Business Use Of IT Is Still In Its Infancy

In historical terms, the impact of IT is still at an early phase. Many economists would contend that it took some 50 years before the benefits of steam power or electricity were fully realised. While the pace of change and adoption of IT has been more rapid, it seems reasonable to argue that the full benefits or impacts of IT have yet to be revealed. Compared to the development of the motor industry, SRI Consulting argue that the Internet has yet to reach the sophistication of the Model T Ford. It is nearly 30 years since the Internet was invented, however the medium is still clumsy and slow, although it's improving steadily. Only in the last few years have enabling technologies (cheap processing power and high-speed connections), converged to make the Internet accessible at low cost. Already it has revolutionised thinking across several industries, even though it remains inaccessible to 90% of its potential users.[1]

To date, use of multimedia has been through network devices adapted from equipment designed for other purposes: devices such as the PC (designed for standalone computing) or the TV (designed for receiving broadcast television). We are now witnessing the first steps towards convergence: i.e. devices designed specifically for the purpose of networked media access, such as digital television. Similarly, in the next decade we can expect to see the evolution and spread of increasingly sophisticated, diagnostic, intelligent systems, manipulated via voice recognition rather than keyboard access.

The impact of multimedia has also yet to be fully appreciated. The power of audio, image and video are becoming more integrated into everyday personal computing. Most new PCs are able to handle new forms of input beyond the keyboard, such as scanners, cameras or microphones. Research on personal multimedia suggests that considerable improvements in task and learning efficiency can be achieved. Multimedia tools could become the basis for lifelong learning as they become increasingly integrated into the world of work.[2]

2.2 The Dynamic Nature Of IT

The IT industry is characterised by increasingly short product cycles and a rapid pace of technological change. For example, many users have only just got to grips with Microsoft's Windows 95 before they are confronted with Windows 98. The OECD calculates that 60% of IT software is less than 2 years old, and that the average shelf-life of technical skills (i.e. knowledge of a particular product) is only 2 years.[3] The driving force in terms of the spread of new technologies, will continue to be the adoption and acceptance of *standards* rather than the best performing *product*. Witness the triumph of Microsoft (and PCs) over AppleMac, not necessarily because the former offered a better product, but because it was able to establish itself as the standard product for most users.

[1] SRI Consulting, 'Future Information Infrastructures: the Move to Intimacy', 1997.
[2] Tapscott, D., 'The Digital Economy', 1996.
[3] OECD, 'Technology Productivity and Job Creation', 1996.

Certainly, IT is here to stay, but it is very difficult to predict the direction of change from our current position. We are not at a vantage point and have little idea how the upgrade of our Model T Ford to a Lotus Elan will effect the world of work. What can be stated with certainty, is that an individual's flexibility and basic aptitude with IT will remain key skills for business competitiveness: simply being competent with one particular product will not ensure *long term* success.

2.3 The Impact Of IT On Business Performance

Despite the growing power and influence of IT, many senior executives remain sceptical of the benefits that IT is supposed to confer[4]. Surveys of 'middle market' firms (typically with 50 to 500 employees) by Coopers and Lybrand find that there is little proof that high rates of IT adoption cause improved business performance.[5] Although IT may be considered essential to basic business operations, in terms of achieving competitive advantage, small firms tend to rank new technologies below other critical success factors in explaining their performance.[6] This is supported by surveys of Europe's high-growth, small businesses indicating that dynamic entrepreneurs tend to regard soft competencies (marketing and human resources) as more critical to business performance than hard competencies, such as acquisition of new IT.[7] The underlying theme from these surveys, is that buying the most recent IT products will not secure competitive advantage. Other business skills, such as management of human resources or marketing still remain fundamental.

Moreover, across all sizes of business, it is the successful *application* of IT, as opposed to its acquisition or technologically advanced properties, which will help underpin competitiveness. The use of IT as a business tool and its successful integration with corporate objectives remains a major concern for many businesses[8] Furthermore, effective implementation of major IT projects is problematic. Analysis by Price Waterhouse of the financial services sector showed investment in IT projects reaching a new peak in 1997, but fewer projects were being delivered on time and budget.[9]

2.4 Where Are The Business Benefits From IT?

More generally, trying to quantify the contribution of IT to economic performance is difficult. In this respect, economists have pointed to a so called 'productivity paradox' - the apparent lack of productivity improvements in advanced economies despite the rapid spread and utilisation of IT. As the US economist, Robert Solow, has claimed: 'We see computers everywhere but in the productivity statistics'. In part this may reflect statistical shortcomings. Measuring productivity in the Information Economy is difficult, and official statistics have struggled to keep up with the

[4] Warwick Business School, 'The Information Challenge - Making Your IT Investment Pay Off', 1996.
[5] Coopers and Lybrand, 'Middle Market Barometer 2 - A Focus on Competitiveness', Summer 1996.
[6] Hepworth, M. and Blizzard, D., 'The Use of Information and Communication Technologies by Small Firms in Business Services: A Review of the Literature', Small Business Research Centre, 1996.
[7] European Foundation for Entrepreneurial Research, 'Europe's 500', 1996.
[8] Price Waterhouse, 'Information Technology Review - 1995/96', 1996.
[9] Price Waterhouse, 'UK Financial Services IT Survey 1997', 1997.

changing nature of many advanced economies in terms of the efficiency with which new products and services are produced.[10] For example, productivity improvements in a steel factory are relatively simple to calculate in terms of the increased quantity of steel that is produced per employee. On the other hand, a small consultancy exploiting desktop publishing packages may be able to produce written material of a quality that was unimaginable some few years earlier. However, this improvement in 'productivity' is not readily captured within standard official statistics.

Unfortunately, this 'productivity paradox' may also reflect more tangible problems in the use of IT, as illustrated earlier. In particular it may indicate a shortage of the particular skills required to successfully exploit IT. Perhaps not surprisingly, businesses, and especially small businesses, often find it difficult to ascertain the efficacy or contribution of IT to their operations.[11] This is not a new issue. The 'IT Skills in the 90s' report undertaken in 1992, also indicated that while businesses were investing significant amounts in IT they were unable to quantify the returns on their investment with any degree of certainty.[12]

In conclusion, we can see that IT is essential to business operations, and significant numbers of businesses continue to accept investment in IT as a given, however we have yet to properly understand how IT can be fully exploited or to quantify the impacts that it has on productivity.

[10] Quah, D., 'The Invisible Hand and the Weightless Economy', Centre for Economic Performance Occasional Paper No 12, April 1996.
[11] Small Business Research Trust with Lloyds Bank, 'Information Technology', Quarterly Business Management Report, 3 (1), March 1995; also IT Skills Forum follow-up to the '93 IT Skills Report'.
[12] West London Training and Enterprise Council, 'It Skills in the 90s', 1993.

KEY POINTS

- The IT sector is unique in terms of the speed at which new products, services and occupations are being developed or created.
- IT is still at an early stage of evolution - we are only just beginning to understand its impact on business.
- Penetration of the economy has been dramatic - IT is increasingly important to ever more businesses.
- Despite massive investment, the benefits of IT do not appear as strongly in the productivity figures as might be expected - there is a 'productivity paradox'.
- This could reflect a failure of official statistics to adequately capture the improvements that IT is delivering. It could also reflect a failure of businesses to *successfully exploit* IT.

3. IT LABOUR MARKET ESTIMATES

3.1 The Demand For IT Professionals

The number of organisations that *do not* make use of IT is small and shrinking fast, and the demand side for IT skills now incorporates organisations from all sectors of the economy. This includes the IT skills required by the IT industry itself and those organisations within the service sector (including the public sector) for whom information management is paramount. However, IT continues to penetrate ever more activities to become a critical supporting service to most businesses in manufacturing and more labour intensive areas. Thus the demand for IT products and services, and consequently IT skills, comes from a diffuse collection of activities.

How Many IT (Or IS) Professionals Are There?

Various attempts to quantify the size of the market for IT professionals are given in Table 1. The focus here is on IT (or IS) professionals as opposed to all users of IT. Clearly, this category is difficult to define and is not readily identifiable within official data sources. The range of figures given in Table 1 reflect a mix of different databases and the variety of definitions used for 'IT professionals'.

However, there are some general rules of thumb. For example, an IT professional will have IT skills beyond the basic applications knowledge of software packages. Similarly, it is necessary to differentiate between someone who may work with IT for the vast majority of their time, such as a basic data entry worker, and someone engaged in more complicated work such as network management. The former, clearly has different skill requirements from the latter and would not be considered an IT professional. Establishing a clear definition of which occupations constitute IT professionals is important not just for the quantification of labour supply and demand but critically for the effective design and delivery of skills training.

Information from the Labour Force Survey (LFS) classifies people according to the nature of their job, as opposed to the economic activity or sector of their workplace. The survey only covers Great Britain: Northern Ireland is excluded. Analysis already undertaken on the LFS has produced the figures given in the first row in Table 1. This suggests that there are at least 600,000 IT professionals in Great Britain, a widely quoted figure.

Working from a variety of sources, the ITNTO has estimated that 250,000 of these professionals work within the IT industry, while another 350,000 are to be found in other industry sectors. However, the 600,000 figure does not account for IT professionals who would be classified under other SOCs, for example teachers, training staff, and management.

The 600,000 figure does include SOC 490 which on first view does closely match with the skill levels of an 'IT professional'. However, it falls under the larger SOC grouping, 49 - 'Clerical and Secretarial Occupations…' and specific job roles included are 'data processing operators' and 'other office machine operators'. Referring back to the rules of thumb for defining IT professional then this group would seem to fall outside the definition of an IT professional. Therefore, SOC 490

should be subtracted from the total, giving revised estimates of 418,000 employees and 39,000 self-employed (total IT Professionals - 457,000).

Table 1: Delineating the IT labour market - Figures for IT/IS Professionals

Data source	**Key figures (and forecasts)**
Labour Force Survey (e.g. Spring 1996) Includes the following occupations SOC* 126 computer systems, etc. managers 214 software engineers 320 computer analysts, programmers 490 computer, etc. operators 526 computer engineers, etc.	Employees 543,000 Self-employed 44,000 Total 587,000
DfEE data Further Education and Higher Education staff numbers	Full-time, IT & System Sciences Staff 1994/95 HE 4600 FE 2400 1995/96 HE 4600 FE 2200
IBM analysis (based on SIC** data) People in computer related jobs	1996 708,000 2002 952,000 Forecast increase of 34%
USA - Bureau of Labor Statistics Occupation Systems analysts Database administrators, computer support specialists, and all other computer scientists Computer engineers	Forecast change in employment 1996-2006 103% 118% 109%

Notes: *Standard Occupational Classification
**Standard Industrial Classification

The second row in Table 1 seeks to give an indication of the number of teaching staff that might be included in the total for IT professionals. An accurate breakdown for IT staff in the FE sector is not available, therefore the figure has been derived assuming the same ratio of IT staff to 'all staff' as exists for the HE sector. This gives a total figure of 6,800 full-time staff in the UK. Data from the 1996/97 Secondary Schools Curriculum and Staffing Survey (England only) indicates that in 1996 there were approximately 5,700 teachers with a degree in Design and Technology, Information Technology or Other Technology.

A further occupation that could meaningfully be included within IT professionals is SOC 213 - 'Electronics Engineers'. In 1996 this SOC included 29,000 people. If these additional figures are included with the revised LFS data a new total of 498,500 is produced (including 39,000 self-employed). As before, certain IT professionals will have been missed: part-time lecturers and some training staff, amongst others. Also, there are problems produced by the different geographical basis for the various data sets.

The forecasts from IBM for computer related jobs (third row of Table 1), are based on various sources including the Labour Force Survey and the DTI's Inter Departmental Business Register. They also rely heavily on data from the Annual Employment Survey that seeks to classify *employees* according to the sector within which they work. It does not provide information about the particular roles they fulfil. For example, SIC 30 (Manufacture of office machinery and computers) would give an indication of people in computer related jobs, but this does not equate to IT professionals. This total will include many employees performing routine assembly work. Therefore, working with SIC data to produce totals for IT professionals requires several assumptions to be made about the occupational profile of employment within various sectors. This reworking of the data may account for some of the differences between the IBM totals and those derived solely from the LFS.

Further indication of trends for Great Britain are given in Figure 1 which presents occupational employment data from the Labour Force Survey. Between the first quarter of 1992 and the first quarter of 1997 the number of 'Computer Systems and Data Processing Managers' in employment increased by 21.5%. For 'Computer Analyst/Programmers' the increase was 14.9%, for 'Software Engineers' it was 100.0%, and for 'Computer Engineers, Installation and Maintenance' the rise was 19.8%. Analysis of job adverts also gives an indication, albeit only partial, of the increased demand for IT professionals. SSP's (Salary Survey Publications) review of adverts for IT specialist jobs showed that nearly 190,000 positions were offered in 1997, an increase of 38% on the number of jobs advertised in 1996.

Forecast Growth

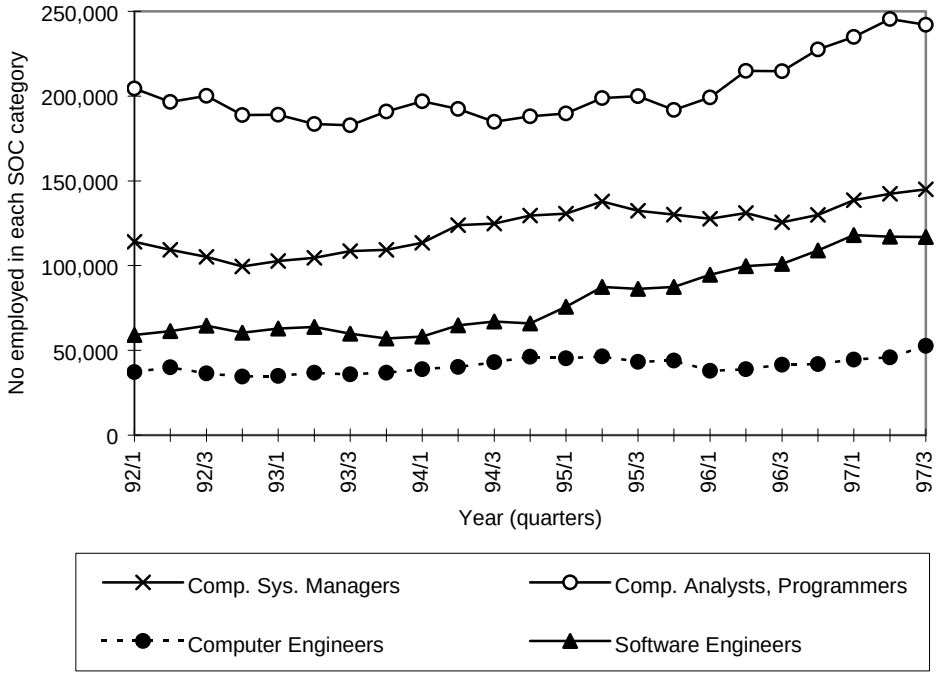
As to future trends, the forecasts from IBM are for an increase of 34% in computer related jobs between 1996 and 2002. The Institute for Employment Research (IER) projects an increase of approximately 28% in employment for computer services over a similar period, although the classifications used are not strictly compatible.

Finally, the US Bureau of Labor Statistics (BLS), produces extensive labour market data and forecasts (Table 1). The three occupational categories given in Table 1 do not cover all IT professionals, but give a strong indication of the trends that are predicted. The projected growth in numbers is clearly quite dramatic - these three groups are forecast to have the fastest employment growth of any occupations in the US. Moreover, the *industry category* that is projected to experience the fastest employment growth over the same period is 'Computer and data processing services' (108% increase). Notably there is a large difference in the forecasts for growth between the US and the UK statistics, again reflecting the difficulties associated with quantifying IT employment and the future dynamic of change. However, the larger estimates given by the US figures, if true for the UK, would suggest a dramatic potential increase in demand.

In terms of *end-users* of IT, as opposed to IT professionals, numbers are estimated to be approximately 13 million.[13] The IT Skills Forum forecasts that by 2000, over 90% of the workforce will interface with IT at work.

[13] ITNTO estimates and SRI Consulting, 'Future Information Infrastructures: the Move to Intimacy', 1997.

Figure 1: Trends in the number of IT professionals, 1992-97



Source: LFS; data is for Great Britain only

3.2 The Supply Of IT Skills

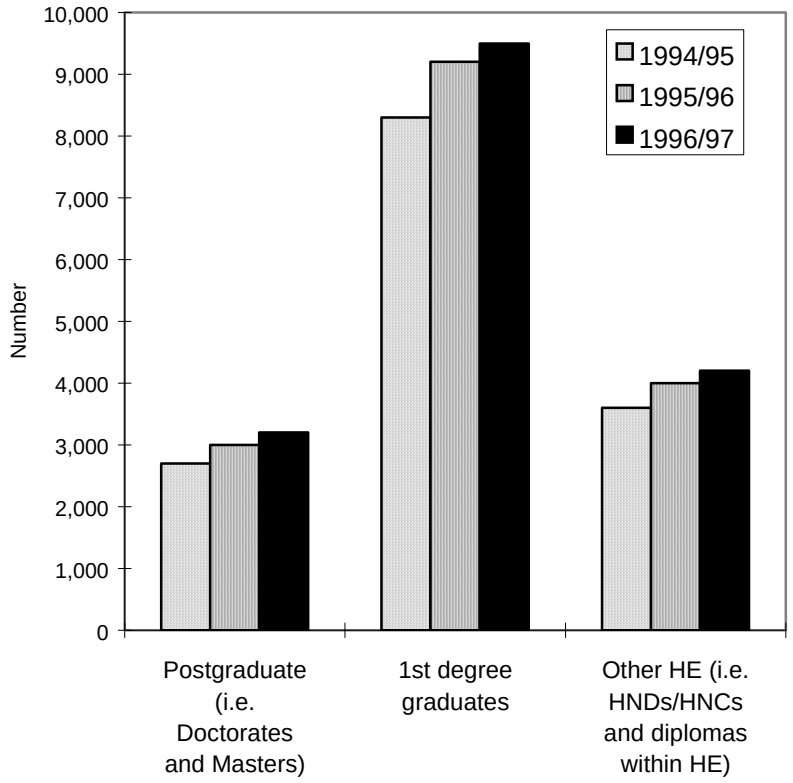
The supply side for IT skills is also diffuse. Examination of supply potentially requires analysis of IT education and training provision from every establishment in the education sector, from primary through to further and higher education. It also has to assess the contribution from commercial training organisations and IT suppliers who provide considerable training to ensure an educated and receptive market for their products and services. Finally within the supply side are those organisations for whom a key task is to marry the demand for and supply of IT skills, including TEC/LECs, specialist recruitment firms as well as industry and trade bodies, and the ITNTO. Based on available information the following attempts to delineate the volume of supply.

The HE Sector

The supply of IT qualified people from the education and training system has grown in recent years. Unfortunately, changes in the method of data collection between 1993/94 and 1994/95 make it impossible to derive meaningful long-term trends. As Figure 2 illustrates, in 1996/97, approximately 9,500 students graduated from higher education with a degree in computer sciences - a 14% increase on 1994/95. Some 3,200 obtained postgraduate qualifications and some 4200 obtained 'other HE qualifications (HND/HNCs, Diplomas etc.). In terms of gender, female numbers as a

share of the total remained broadly constant between 1994/95 and 1996/97, being 22% for postgraduate qualifications, 22% for 1st degrees and 26% for 'Other HE'.

Figure 2: Computer sciences qualifications obtained
All HE institutions in the UK (Computer Sciences only)

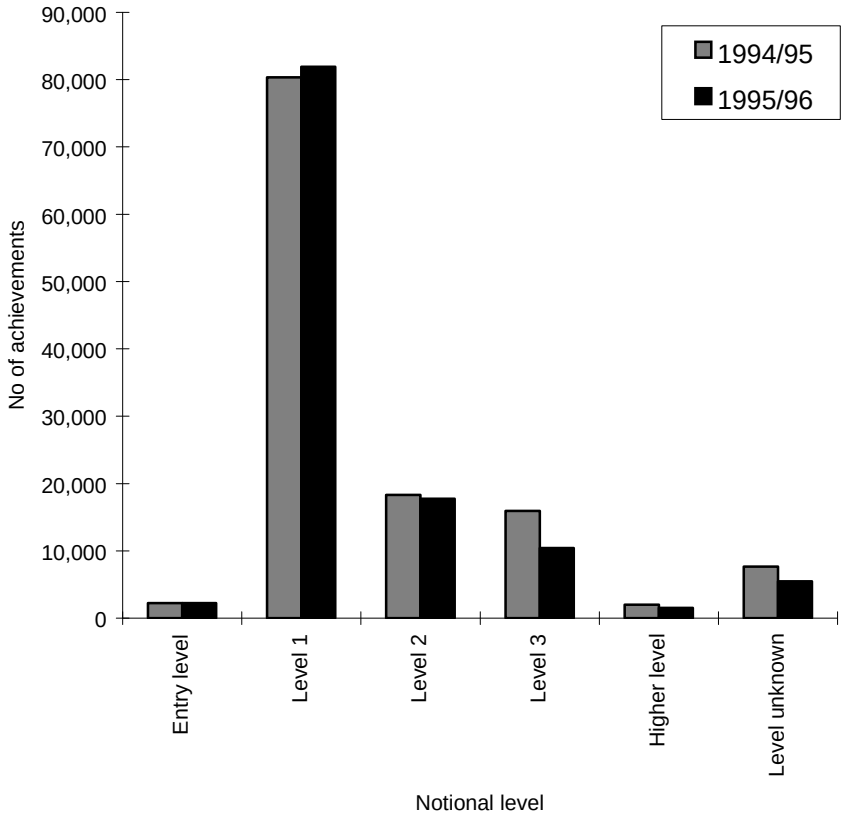


Source: DfEE

The FE Sector

During the last 7 years enrolments in computing at FE sector colleges have increased dramatically, although between 1994/95 and 1995/96 the number of achievements dropped by 5.7%, from 126,438 to 119,258 (Figure 3 - England only). This is likely to be reversed in 1996/97 due to a substantial increase in enrolments - up by 36.6% - although this mainly represents an increase at Level 1 (Higher Level enrolments were actually down). Clearly much of this training will not provide students ready to become IT professionals, however these achievements are important in terms of raising awareness and establishing a base of end-user skills.

Figure 3: IT Achievements - FE sector Colleges in England



Source: DfEE, Individualised Student Records

These figures provide some indication of the supply of labour from the education sector to the market in simple terms of numbers, although actually deriving a figure for the supply to the market is difficult. Insufficient destinations data means it is not possible to estimate the number of graduates who enter IT jobs. Clearly, many graduates without Computer Sciences degrees will become IT professionals, notably those with numerate degrees. Other IT graduates may go on to higher degrees before entering the labour market. Moreover, whether the education sector is providing an adequate base in terms of quality and relevance of skills is a key issue for debate.

The Role Of Employers

Another important contribution to the IT skills base is made by employers themselves. Unfortunately, beyond partial data from surveys, creating additional information on employers' IT training is problematic. The ITNTO estimates the market for commercially provided IT training to be something in the order of £500m. Research by the Computing Services and Software Association (CSSA) suggests that the software and services industry spends an average of 3% of revenues on staff development and training.[14]

[14] CSSA, 'The State of the IT Nation: a CSSA Survey', 1997.

More generally, an indication of the importance that employers attach to this area can be gleaned from the Skill Needs in Britain survey (1997). Although not able to isolate IT-specific training (and excluding businesses with fewer than 25 employees), the survey indicates that 82% of employers provided off-the-job training in the previous 12 months, and that of these, 59% provided training in 'new technology'.[15] The Motorola Report suggested that 31% of men and 23% of women in the UK are trained in IT by their companies.[16] Comparison with other countries suggests that Britain performs well. On average, UK businesses provide access to more IT training than their French or German counterparts.[17]

3.3 The Geography Of Demand And Supply

At higher skills levels, recruitment is unlikely to be confined to a local labour market. PhD, post-doctoral employees or those with highly sought after skills will be recruited from the national or international job market. At lower skill levels (for example, technicians) staff will typically be found in the local labour market. Given the absence of suitable data it is difficult to adequately map the distribution of IT professionals, however IMIS (The Institute for the Management of Information Systems) asserts that over half of the professional IT workforce still lives and works south of Northampton and east of Swindon (Table 2).[18]

Relocation's during the 1980s did not significantly change this pattern, although there was movement out from London along the eastern end of the M4 corridor and, to a lesser extent, out to the rest of the M25 ring (Table 2). The IMIS believes that the last three years have seen some drift back to Central London from the rest of the South East, but not from the rest of the country.

Note that regional analysis of the Labour Force Survey could provide additional information on these trends, even though inadequate sample sizes would impose considerable restraints.

[15] Only health and safety training (84%) and induction training (75%) were provided by more employers.
[16] The Motorola Report, 'The British and Technology', 1996.
[17] Spectrum Strategy Consultants for the DTI, 'Moving into the Information Society', 1997.
[18] Virgo, P. for The Institute for the Management of Information Systems, 'Spring 1997 Update to The End is Nigh - 1996 IT Skills Trend Report', 1997. It should be stressed that these figures are based on analysis of job adverts, rather than a comprehensive database of IT professionals.

Table 2: Readership of Computer Weekly by location 1991-96

	1991	1994	1995	1996
Greater London	17.0	12.4	13.1	13.5
South & East	38.8	40.8	40.1	39.8
SW & Wales	10.1	10.8	10.6	10.6
Midlands	12.4	13.3	13.7	13.7
North	16.8	17.2	17.3	17.2
Scotland	4.3	4.7	4.5	4.5
Northern Ireland	0.6	0.8	0.7	0.7

Source: BPA Analysis of Computer Weekly Readership

Analysis of job advertisements by SSP (Salary Survey Publications) indicates that the largest increases over 1997 occurred in the remoter parts of the country. The jobs on offer in Scotland, northern England, Wales and the West more than doubled over the fourth quarter of 1997 in comparison to the final quarter of 1996. In London and southern England, the increase was well below the average. This area accounted for just under 60% of all jobs on offer as opposed to more than two thirds the year before.[19]

[19] Computer Weekly - Salary Survey Publications (SSP), 'Survey of Appointments Data and Trends', January 1998.

KEY POINTS

- Existing statistics do not provide adequate information on the number of IT professionals in the UK economy. Estimates from various sources put the number of IT professionals at anything between 499,000 and 708,000.

- Projections for the future growth of IT professionals over 1996 to 2002, vary between 28% and 34%. In the 10 years to 2006, the US Bureau of Labor Statistics has made projected increases in the region of 100% for the main IT professional occupations.

- There are at least 13 million end-users of IT. By 2000, over 90% of the workforce is expected to interface with IT.

- The supply of IT qualified people from the education sector has increased. In 1996/97, 9500 students graduated from Higher Education with a degree in computer sciences (14% up from 1994/95), 3200 obtained postgraduate qualifications and 4200 'other HE qualifications'.

- The contribution of employers to the IT skills' base is difficult to ascertain. Surveys indicate that IT training is a high priority for many businesses. International comparisons suggest that the UK performs strongly in this respect.

- Over half the IT professional workforce lives and works south of Northampton and east of Swindon.

4. ASSESSING IT SKILL SHORTAGES

4.1 What Is A Skills Shortage?

The fundamental question in examining supply and demand statistics is whether supply is adequate to meet current and predicted demand or whether in fact skill shortages exist. The general view is that IT skill shortages do exist. However, many of the statistics cited as evidence of a skills shortage, may in fact be indicative of other labour market trends rather than a shortage of the requisite IT skills. For example, recruitment difficulties may simply reflect churning in the job market as IT professionals use 'job hopping' to develop their career path. It is also useful to differentiate between skills shortages and skills gaps. Skills shortages are typically defined as being where an employer is unable to recruit *new suitably skilled people* to fill a business need. Skills gaps refer to skills which *existing employees* do not possess and which consequently can hamper business growth.

4.2 Possible Evidence Of An IT Skills Shortage

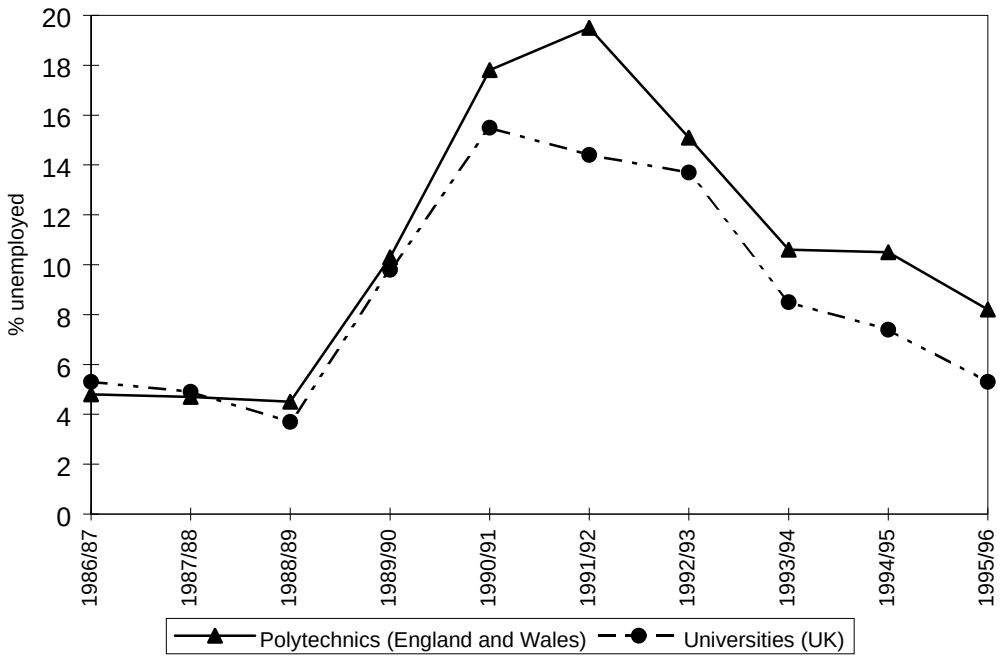
A general tightening of the labour market allied with mismatches between skills in demand and those available, tend to be marked by employers reporting greater problems in recruiting staff and in turn, citing skills shortages as a reason for this. The percentage of IT graduates failing to secure employment has dropped steadily (Figure 4), suggesting a degree of labour market tightening as the economy has recovered from recession.

This is also supported by recent comparisons with the success of other graduates. Of those obtaining a first degree in computing science for 1994/95, 10.4% were recorded as unemployed from first destination data. This compared with a rate of 9.2% for all other first degrees. However, for 1995/96 computer sciences graduates out-performed the average for other degrees: their unemployment rate dropped to 7.7%, while the rate for all other first degrees was 8.2%.

In terms of indicators from other sources, outputs from various business and salary surveys, also give indications that IT skills shortages may be a serious issue.

- An NOP survey undertaken on behalf of Microsoft found that 73% of 'people in the computer industry' believed there to be an IT skills shortage, although IT developers were the least likely to believe there was a shortage (61%).
- Computer Economics estimate that over 90% of IT firms recruited in 1997 compared to just over 80% in 1996 and just over 70% in 1995. Of those recruiting in 1997, 83% encountered some kind of problem in finding staff.
- The same source reports that average basic salary increases for IT specialists were 4.9% for 1997 (7.9% when merit and performance increments were taken into account). The forecasts for 1998 are 5.1% and 7.9% respectively.

Figure 4: First Destination of IT Graduates from Higher Education



Source: DfEE

4.3 Possible Evidence Of An IT Skills Gap

In terms of skills gaps for particular IT occupations, the ITNTO has identified the following areas as a cause for concern.[20] For IT professionals within the 'IT industry', there appears to be a significant deficit of mandatory competencies for Information Systems Analysts, Installers of IT Products and Operators of IT. In 'Other Industries', significant shortfalls are present for Information Systems Analysts, Operators of IT, and those responsible for Supporting Users of IT.

More anecdotal evidence of skills gaps can be found from various sources.

- Skills Needs in Britain (1997) reports that of the 18% of employers who felt that a skills gap existed with their employees, 55% said that computer literacy was lacking.
- For small businesses, surveys suggest that deficiencies in IT skills are an important skills gap. For example, a recent British Chambers of Commerce survey indicated that computer/IT skills deficiencies in management/professional staff are the most acute skills gaps. This was also true for clerical/office/sales staff and skilled manual/technical staff.[21]

[20] This is based on a 1997 analysis of data from some 300 businesses

[21] British Chambers of Commerce, 'Small Firms Survey - Skills', January 1998.

- Analysis of the UK financial services sector suggests that a major concern is the changing skills required by IT staff. This issue appears to be moving up the list of IT directors' priorities.[22]

These pieces of data need to be placed in a wider labour market context. It is important to differentiate between skills shortages that are temporary products of the labour market, for example, as the supply-side takes time to adjust to the rapid pace of change in demand, and more endemic or structural skills shortages that represent long-term deficits in the skills base. There is also a need to isolate skill deficiencies in terms of functional problems, for example, that relate to the use of a particular piece of software, and problems arising from a shortage of more general or core skills such as project management, communication or knowledge of programming fundamentals.

KEY POINTS

- There is evidence of both IT skills shortages and skills gaps. Skills shortages arise when an employer is unable to recruit *new suitably skilled people*. Skills gaps refer to skills which *existing employees* do not possess and which hamper business growth.

- Tightening in the labour market for IT graduates, and various recruitment surveys indicate that there are IT skills *shortages*. Several business surveys also highlight IT skills *gaps* within businesses.

- Wage inflation for IT professionals suggest a further tightening of the labour market.

- It is important to differentiate between temporary problems and more deep seated supply shortages.

[22] Price Waterhouse, 'UK Financial Service IT Survey 1997', 1998.

5. IT SKILLS - KEY ISSUES AND TRENDS

In terms of the key issues and concerns surrounding IT skills and the successful exploitation of IT, it is useful to focus on four themes or target markets: IT professionals; large businesses or corporates; SMEs (Small and Medium Size Enterprises); and IT end-users.

5.1 IT Professionals

Demand For Product Specific Skills

Evidence from salary surveys and industry sources[23], indicate increased demand for certain product specific skills, namely: Unix, C/C++, Oracle, Visual Basic and Windows NT (Figure 5). These findings are broadly supported by the NOP/Microsoft report which suggested that Windows NT, Oracle, Microsoft Word and Visual Basic were the product specific skills most in demand. The same survey indicated that Windows NT, then Oracle and Visual Basic were the skills where most respondents felt that demand far exceeded supply.

Short-Term Problems

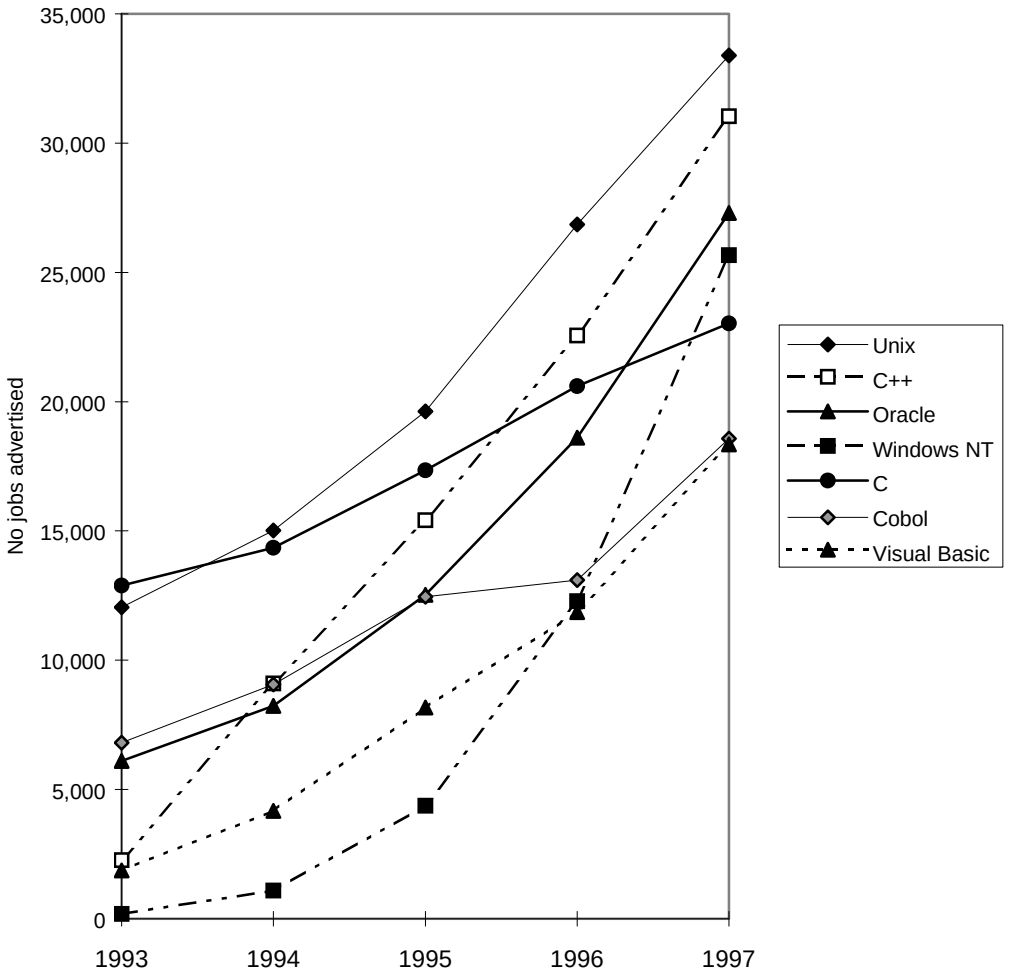
In the short-term, product specific skill shortages appear to be worsening due to the pre-occupation with meeting Yr 2000 and EMU deadlines. Concern has been expressed about a lack of Cobol and Bal programmers to work on legacy systems[24] and there is evidence of recent peaking in recruitment advertising for analyst programmers, especially with experience of programming in Cobol (see also Figures 1 and 5). However, predicting the impact of these one-off peaks in demand has been notoriously difficult. A recently published report by Hay Management Consultants of 40 blue-chip IT departments and consultancies, suggests that forecasts of compliance staffing levels for EMU and Yr 2000 have been too high. Hay forecasts that only 17 to 28,000 people will be engaged in Yr 2000 work by mid-1998 when resource levels for Yr 2000 are expected to peak. Earlier projections had suggested staffing levels of up to 300,000. Furthermore, this report identified the key driver of IT staff recruitment, as the resourcing demands presented by new business systems, rather than issues relating to EMU or Yr 2000 compliance.

Many companies have imported foreign specialists to help tackle Yr 2000, a move that has been criticised by The Manufacturing Science and Finance Union (MSF) as a stop-gap measure, indicative of a failure to invest in people. However, given that this influx is a one-off to deal with a discrete skills problem, one could argue that it is a more cost effective and responsive solution to a pressing business problem rather than investing resources in training individuals in legacy skills. The shortage is not necessarily the product of a deep-seated and long-term skills shortage and so

[23] Computer Economics Limited, 'Computer Staff Salary Survey', 1997; Computer Weekly - Salary Survey Publications (SSP), 'Survey of Appointments Data and Trends', January 1998; CSSA, 'The State of the IT Nation: a CSSA Survey', 1997; and industry sources.
[24] Ivinson, J, 'Mid-life crisis?', British Computer Society Review and Directory, 1997.

recruitment from within the international labour market might be an appropriate solution.

Figure 5: Jobs advertised by software skill



Source: Computer Weekly - Salary Survey Publications, survey of appointments data and trends, 1998.
(It should be stressed that these figures are only for *jobs advertised* in the quality national dailies and IT business magazines, and can only give an incomplete picture of demand)

Demand For More General IT Skills

In terms of general IT skills and competencies, those most in demand are knowledge of networking and operating systems. Core skills such as customer service and effective communication with users are also heavily sought after.[25] With regard to job categories, SSP reports significant increases in demand for operations staff (although from a relatively small base), systems analysts and technical support staff.

[25] NOP Research for Microsoft, 'IT Skills Survey', January 1998.

There has also been a strong increase in advertisements for project managers (from a relatively large base).

The Interaction Between Demand And Supply

The key issue for policy development and assessment of IT skills shortages is the interface between supply and demand, and the responsiveness of the training infrastructure. In terms of the supply/demand interface, there are often considerable difficulties in articulating the needs of business and relating these needs to the products that training providers can deliver. The simple supply-demand model typically assumes that the demands of companies are rational and thoughtful, can be clearly articulated and communicated, and can be turned into products and services that suppliers can provide. Such a model also assumes a degree of consistency of demand.

On the supply side, there is anecdotal evidence that higher education is not producing graduates with the IT skills which the market requires. On occasion, public sector IT training providers are viewed as remote professionals, offering inflexible courses, and delivering products that are out of line with business needs. For example, The NOP Microsoft business survey indicates that universities and colleges of higher education see programming and software development as the area of greatest demand. However, this is noticeably out of line with IT managers who ascribe it a lower priority. A greater share of IT managers see networking and operating skills as more important than those in higher education[26].

Clearly some problems and differences of opinion will always exist. Those in higher education regard their role as providing education rather than training, while businesses are not always best placed to give an unbiased and strategic account of future needs. Furthermore, universities will not always have the resources to provide teaching in the most up to date practices and methods. However, the problems, such as they are, should not be overstated. The CSSA reports that 69% of software/IT services businesses are broadly satisfied with the abilities of the graduates that they recruit[27]. Nevertheless, there is clearly scope to build a more effective interface between the 'two sides'.

The responsiveness of suppliers to changes in demand is another key factor. The demand side wants appropriate IT professionals now. It always has and, no doubt, always will. However, the supply side needs time to develop and deliver training in IT skills. To revise and implement a new curriculum in higher education may take years. Therefore, it is vital to differentiate between skills that will retain their relevance - deep underpinning knowledge and understanding that eases personal updating and portability across existing and new platforms - and more specific, technical skills that may be required in the immediate future, but do not confer flexibility. Revising curricula to deliver these more transient skills will serve little use. However, if there are shortages in the deeper IT skills, this presents more difficulties than shortages in application specific skills, especially if shortages in the latter relate simply to one off or temporary problems.

[26] NOP Research for Microsoft, 'IT Skills Survey', January 1998.
[27] CSSA, 'The State of the IT Nation: a CSSA Survey', 1997.

The Key Points Table attempts to summarise the main issues surrounding the IT workforce and skills issues: these are categorised as 'Temporary/One-off' or 'Long-term'. 'Long-term' relates to skill demands or skill related issues that will continue to have relevance beyond the immediate future. However, it does not necessarily imply that these problems will take a considerable time to address.

KEY POINTS	
Temporary/One-off	**Long-term**
	Technology
• Validation of legacy systems for Yr2000 compliance. Temporary peaking of demand for Cobol, Assembler, RPG etc.	• Rate of change of new technology. E.g. software suppliers saturating users with new releases
• Revision of financial systems to allow for EMU (one-off, but different level of problem compared with Yr2000)	• Complete integration of computing and communications leading to increased demand for comms specialists. E.g. rise of call centres, electronic trading, Internet/Intranet/Extranet
	• Growth in adoption of multi-media and the beginning of the transition to broadband multi-media for marketing, customer support and information systems, as well as for leisure and entertainment purposes
	Skills problems
	• Failure to develop management skills for technologists. Increasing evidence of project failures and slippages[28]
	• Poor base supply stemming from a lack of investment in training by employers and inappropriate degree course. Concern about quality of students taking IT courses and failure to attract more women
	Human resource strategies & image
• Overheating of the IT skills market exacerbated by employers offering inflated salaries to those people ready equipped with the necessary skills	• Retention and recruitment of staff, including lack of demonstration of IT as an interesting career with promotional paths

5.2 Large Businesses/Corporates

Staff Recruitment And Retention

A key concern for large employers remains IT staff recruitment and retention. Computer Economics Ltd indicates that 72% of companies experienced some

[28] For example, Price Waterhouse analysis of financial services sector, 1997.

difficulty retaining their IT staff during 1997, 34% up on last year's figure of 53%.[29] Employers are often seeking to meet specific functional shortages by buying in the requisite skills. Such a strategy clearly favours those with the deepest pockets, such as businesses within the financial sector. In a bid to recruit and retain staff, companies are also seeking to offer better packages in terms of fringe benefits and bonus payments.[30] There is evidence of staff retraining and skills upgrading, but the extent of this appears to be limited, although this may increase as businesses develop more refined retention strategies. The NOP/Microsoft survey reports that over 50% of recruitment consultants believed their clients used high salaries to retain their staff and only 18% mentioned training and development.

The spate of mergers sweeping the financial services sector may alleviate some skills difficulties. This sector has been criticised for inflating labour costs within the IT skills markets by creaming off the best IT professionals with the offer of high salaries. However, some IT staff may be released back onto the market as the newly merged companies seek to exploit new economies of scale and rationalise their IT departments.

Trainee Recruitment

The extent of trainee recruitment undertaken by corporates remains limited. While the computer services sector has recently restarted graduate recruitment, the level of activity has not recovered from the cutbacks of the 1990-92 recession. Recent surveys indicate that the proportion of trainees in post fell below 2% during the last recession and has not recovered.[31] While there are no direct figures on the number of trainees, the substantial reduction in the proportion of IT specialist staff aged under 25 is indicative of problems. In 1987, 18.9% of the IT workforce was under 25, in 1993 it was 9.7% and in 1996 it was only 6.2%.[32] SSP (Salary Survey Publications) shows a decline in the number of jobs offered for virtually all trainee posts in 1997.

Outsourcing And Freelance Work

Other strategies to meet skill shortages, involve outsourcing development or maintenance work. IT professionals employed in service companies are predicted to exceed those employed in user organisations by the end of the century.[33] The use of foreign labour has increased dramatically. Work permits issued to foreign computer specialists have almost doubled in the past three years. In the last 12 months, 2,800 permits were issued to specialists in India mainly to tackle Yr 2000 problems.

[29] Computer Economics Ltd, '1998 Survey of Fringe Benefits, Additional Payments and Contract Staff', 1998.
[30] Computer Economics Ltd, 'Computer Staff Salary Survey', November 1997; and '1998 Survey of Fringe Benefits, Additional Payments and Contract Staff', 1998.
[31] Virgo, P. for The Institute for the Management of Information Systems, 'Spring 1997 Update to The End is Nigh - 1996 IT Skills Trend Report', 1997.
[32] Virgo, P. for The Institute for the Management of Information Systems, 'The End is Nigh - 1996 IT Skills Trend Report', 1996.
[33] Annual Employment Survey and industry sources, although Holway, R., 'The Holway Report', 1996, suggests that the cross-over has already occurred.

More generally, there has been a growing employment of freelance contractors and a move of IT staff from permanent employment within large businesses to contracting. While this is not a new phenomenon, it does appear to have been increasing as the demand for some IT skills has inflated salaries. Therefore, retaining permanent IT staff is a key concern for many businesses given that contracted staff tend to be more expensive.

The trend for outsourcing of IT and the movement of IT professionals into contracting doesn't of its own, diminish the existing pool of skills. Concern has been expressed that the desire of contractors to earn money may draw their focus away form the acquisition of new skills (that would have been acquired in their previous positions). However, what evidence there is, suggests a different view, with contractors showing a healthy acquisition of new skills, often acquired by self study as opposed to the more formal routes that contractors would have used in their previous employment.[34]

Outsourcing and freelancing will entail cost and contractual implications for businesses, but they are not necessarily indicative of a skills shortage. Rather it reflects the problems that companies may experience in retaining skilled personnel. The main reasons for this employment churn appear to be employee dissatisfaction with pay, personal development and career opportunities.[35] At the same time, it seems that employers have developed few retention tools apart from the offer of financial incentives. What might also be a cause for concern is the impact that the move away from specialist IT departments could have on the levels of skill and training left in the 'host company'.

The rise of salaries for freelancers and the problems of staff retention, indicate that highly-skilled IT staff are aware of their position within the labour market and are able to exploit the benefits of contracting, or can 'job-hop' as a way of developing their careers. If there is a skills shortage, it will be a product of the numbers of freelancers or consultants, rather than the nature of their employment: be it permanent full-time, freelance or contractor.

5.3 SMEs

The Absence Of IT Departments

The significance of the SME sector will continue to grow both in terms of businesses and share of employment.[36] Lower costs and ease of use will ensure further IT penetration of this sector. However, small businesses tend to lag behind their larger counterparts in their use of IT, and surveys indicate that they struggle to master or develop the appropriate IT skills.[37] Despite lower costs of new technology, it seems unlikely that many SMEs will have the technical personnel to develop, implement and

[34] NOP Research for Microsoft, 'IT Skills Survey', January 1998.
[35] Hay Management Consultants; NOP Research for Microsoft, 'IT Skills Survey', January 1998.
[36] The Henley Centre, 'The Future of Work', 1997.
[37] Spectrum Strategy Consultants for the DTI, 'Moving into the Information Society', 1997; Hepworth, M. and Blizzard, D., 'The Use of Information and Communication Technologies by Small Firms in Business Services: A Review of the Literature', Small Business Research Centre, 1996.

maintain complex IT applications. Those SMEs with IT departments, but running standard IT systems and applications will continue to experience difficulty retaining talented IT professionals, given the opportunities and challenges offered in larger departments or at 'leading edge' IT businesses. With regard to their own skills base, smaller companies regard desktop applications training as being the area of greatest demand for improvements.[38]

IT Support Provided Externally

In this context, buying in IT support and services will be increasingly attractive to many SMEs. This may be reinforced by the development of the 'network computer' - a basic (or 'dumb') terminal supplied with the most recent IT products, delivered via a 'central service provider'. Such technology should enable businesses to have IT products frequently updated at relatively low costs. While this may make it cheaper for small businesses to access the latest products, without effective contract management and user support the benefits in terms of business competitiveness will be limited.

The Need For Solutions Not Technologies

The central issue for SMEs will remain meeting the needs of businesses and providing them with solutions related to their business requirements and strategy, rather than the latest piece of technology. Unfortunately, a tension can exist between suppliers of IT systems, who find it easier to sell, support and upgrade standardised systems, and users (especially small businesses) who want solutions tailored to their needs. Again it is the interface between support providers or IT suppliers, and end-users that has been neglected in most analysis. If small businesses are to successfully buy-in IT, contract management skills allied to a sound understanding of IT are paramount. Support providers and IT suppliers must also develop a better understanding of their clients' needs and business operation.

5.4 End-users

Basic IT Skills Problems

The ITNTO finds evidence of competence shortcomings across all levels of IT end-user. Basic IT literacy, use of spreadsheets, word processing packages and the manipulation of databases, remain problematic for many end-users.[39] Given that the total number of IT end-users is now some 13 million people and increasing rapidly,[40] the importance of these skills shortages should not be underestimated. Unfortunately, many end-users show little interest in IT issues until something goes wrong.[41] However, the development of a sophisticated consumer base is vital if businesses are

[38] NOP Research for Microsoft, 'IT Skills Survey', January 1998.
[39] British Chambers of Commerce, 'Small Firms Survey - Skills', January 1998; Spectrum Strategy Consultants for the DTI, 'Moving into the Information Society', 1997.
[40] SRI Consulting; ITNTO; IT Skills Forum.
[41] Sun Microsystems, 'Stop The Technology Madness', 1998.

to properly exploit IT, both in terms of everyday operations and in terms of supplier evaluation and contract management. The evolution of a sophisticated consumer pool and adequate feedback between supplier and end-users, can also facilitate the successful creation and development of new applications.

Younger Workers And IT Literacy

Several categories of current skills shortages for end-users, particularly those relating to basic computer literacy, may be alleviated as younger workers enter employment. The widespread use of computers within schools, and the greater acceptance and capability of younger people to work with IT should ensure that the workforce becomes increasingly IT literate across most occupations and industries - as is often stated, 'Technology is only technology for those born before it was invented'. This is supported by data from the Skills Needs in Britain survey (1997). Of those firms who employed 16-19 year-olds, 37% thought that a skills gap existed for these employees. However, the percentage specifically mentioning computer literacy as a problem was 20% (as opposed to 55% for all employees - see earlier).[42] It should be noted, that for younger employees, a lack of general communication skills were the most frequently cited problem. Unfortunately, despite the increasing computer literacy of young people, recruitment *into the IT profession* has been poor, indicating a failure to maintain trainee recruitment and attract young people to the profession (see earlier).

Acquisition Of IT Skills

For many end-users, new IT skills are self-taught, and evolve though a process of trial and error. Not surprisingly, many end-users fail to exploit or even understand the full capabilities of the applications they use. Bloor Associates estimate that most users only need about 15% of the functionality provided by desktop software, yet each new upgrade needs more computing power[43].

Where external training is undertaken, there needs to be an assessment of the increasing role played by software suppliers. Many businesses would seek to arrange training on a specific application through the associated supplier, rather than, for example, a local FE college. Suppliers may typically be regarded as more up to date and have a better knowledge of the relevant application.

5.5 Recent Initiatives To Increase The IT Skills Base

Several initiatives, both form the public and private sectors have recently been rolled out to improve the supply of IT skills. On the publicly funded side, the March budget announced an extra £90m in 1998/9 to increase the supply of IT professionals. There have also been nearly 3,100 Modern Apprenticeship starts in IT unto October 1997.[44] From the private sector there has been a number of initiatives. Logica have entered into a joint venture with the University of East London to offer a four-week course

[42] For supporting evidence also see British Chambers of Commerce, 'Small Firms Survey - Skills', January 1998.
[43] Bloor Associates, 'Stop The Technology Madness', Sun Microsystems, 1998.
[44] DfEE sources.

aimed at teaching people with no IT experience, basic IBM mainframe skills, including programme training in Cobol and IMS. All successful students will be offered a job at Logica. The company expects to recruit up to 100 people a year through the scheme. Computer recruitment specialist, CRT, intends to take on 2,000 people and train them as IT specialists. The over-40s, jobless, homeless and single parents are being targeted in a campaign estimated to cost £70m. While there are clearly skills problems still to be addressed, these developments give an indication that some steps are being taken.

5.6 Endemic Shortages? The Implications For Long-term Competitiveness

Communication Between IT Professionals And Users

Increasing penetration by IT of sectors and occupations will mean a growing number of people will be required to work with new technology. For IT professionals, their ability to communicate with end-users will be increasingly important. Unfortunately, there is considerable evidence that the interface between IT professionals and end-users does not function effectively.[45] In many organisations a culture gap exists between IT professionals and other managers, as reflected in differing views on critical IT issues. This culture gap is likely to continue and may deteriorate if key information management issues are not discussed by senior management, but left to the IT department or an external provider.[46]

Any IT skills sector strategy must seek to better appreciate how these relationships function and must equip IT professionals with the skills that will enable them to put IT within a wider business context, to successfully use IT as a strategic business tool and to communicate with non-professionals in a fashion that leads to the successful implementation of IT solutions.

Unfortunately, problems in this area appear to be an ongoing feature of the IT industry. For example, The 'IT skills in the 90s' report based on survey work in 1992 found shortcomings in the basic business skill sets of IT professionals, including communication with end-users. Therefore, although the IT labour market is characterised by rapid change, a persistent skills problem is emerging, relating not to specific products but to more general skills deficiencies. These problems were apparent at a time of looser labour market conditions (i.e. 1992), and still exist today.[47]

Business Development

If the cost of acquiring IT professionals with the correct skills continues to rise strongly, there are clearly implications for new business development. Businesses may increasingly decide that movement into new areas may be uneconomic if additional IT skills have to be brought in at an excessive price. Under such

[45] Focus Central London, 'City Skills Audit - Information Technology and its uses', 1998.
[46] Warwick Business School, The Information Challenge - Making Your IT Investment Pay Off, 1996.
[47] Focus Central London, 'City Skills Audit - Information Technology and its Uses', 1998

circumstances the supply of IT professionals will need to increase or new business opportunities may be closed off.

Specialisation And The Global IT Labour Market

If we return to the issue of demand for functional or product specific skills amongst IT professionals, the use of foreign IT specialists opens a debate into long-term sources of competitiveness. Several IT service companies make use of Indian labour, in particular, workers based in Bangalore, to improve their business performance.[48] For example, highly skilled IT specialists operating from London, design IT business solutions while the more routine programming is undertaken by compilers in Bangalore. By using this 'offshore' location, British companies are able to tap into a cheap source of skilled labour and can exploit the time difference between India and Britain, ensuring that work can take place around the clock. Moreover, high speed datacom links can enable computers, situated anywhere in the world, to be used by programmers in India on a real-time and on-line basis. If necessary, the client is able to monitor software development on a minute-by-minute basis. Clearly, it makes no sense to tool-up UK based workers with the functional skills to compete against this global labour pool: there is little scope for competitive advantage, especially over a sustainable period.

Long-term competitiveness for the UK will be achieved by excelling in the areas of design, development and support operations (including the skills that are vital for customer service). Struggling to produce computer programmers for a particular language, in anticipation of the next trend, may simply be training for obsolescence if workers do not understand the fundamentals and are unable to adapt to change. It will also be paramount for the ever expanding pool of end-users to have the necessary skills to successfully exploit IT and provide meaningful input for the evolution of new solutions - to be 'Sophisticated Consumers'.

KEY POINTS

- Analysis and policy should focus on the needs of different groups of users and the different *markets* for IT services. With regards markets for IT training, many large companies do not see the public sector as their training supplier of choice.
- For IT professionals, the *product specific* skills most highly sought are knowledge of: Unix, C/C++, Oracle, Visual Basic and Windows NT. More general skills, most in demand are knowledge of networking and operating systems.
- IT staff recruitment and retention is a problem for many businesses.
- SMEs typically require a basic level of IT service and support, but do not have the

[48] The following figures give an indication of India's importance in this respect. Between 1990 to 1995, India was the only country to increase software exports by 40-50% compounded annual growth rate (Nilekani, N. 'Passage to India', British Computer Society Review and Directory, 1997).

in-house capability to supply it themselves.

- Many end-users lack IT literacy, however, for younger labour market entrants this is less of a problem.

- Communication between IT professionals and end-users remains inadequate.

- Increasingly there is a global labour market for IT skills. To ensure long term competitiveness, the UK must focus on those skills which create the most value, and are least susceptible to low-wage competition.

6. SUMMARY AND CONCLUSIONS

6.1 Summary

Table 3 seeks to summarise some of the main IT skills issues and concerns identified in the review of existing information. The results are presented by key areas or target sectors. We would suggest that a finer understanding of IT market segments will facilitate the development of a more customised and ultimately effective set of policy solutions to address the problems.

Table 3: Summary Of IT Skills Issues By Target Sectors

Descriptor	Issues
Shortages in IT professionals	• Global markets for certain skills • Role of programmers • Image of the profession and promotion of IT as a career • Emphasise high value functions - design, creation, client handling/customer service
Shortages in IT product knowledge Unix, C/C++, Cobol, Oracle, Windows NT, Visual Basic, etc.	• Temporary and short-term demand shifts • Rate of change makes forecasting product skills difficult • Reluctance of IT industry to retrain - Cobol to Java - need to be addresses • Product training tends to concentrate on features, not their application - often shallow and does not provide fundamental basis on which further development can be built • Who is the training provider of choice - should the education institutions concentrate on the provision of foundation skills? • Timing of response is key - private sector providers best placed?
IT professionals - business skills deficits	• Lack of IT use as a strategic business tool • Inadequate accounting of impact on productivity • Information management strategies and skills • Communication skills • Project management skills • Client handling/customer service • Outsourcing and freelancing an effective solution for technical skills
Business managers	• Articulating needs - specification of contracts/purchasing • SMEs as a special market requiring special solutions • Need to develop sophisticated consumers • IT as a strategic business tool • Information management strategies

End-users/Constructive users	• Learning - is it self-taught? What is the level of under-utilisation of capacity? • Training provider of choice: for example, software supplier or college? • Utilisation of applications - underused?
Training and education - provision of IT skills	• Capacity of infrastructure - resources • Access to hardware and software developments • Quality of trainers - constant up-dating required • Attitude of teachers - skills and competencies in schools part of the long-term solution • Interface between business demand/needs and supply needs to be improved • Need to recognise different training markets and develop appropriate solutions to ensure adequate responsiveness • Training market needs to mature - look beyond short term technical fixes to long term fundamental changes

6.2 Data Considerations

The quality of IT related LMI needs to be improved. Successful policy development will be hindered without better data on absolute numbers, competencies and time series that can give an indication of trends and dynamics. Official statistics still do not adequately reflect the transformations that the UK economy has undergone in the last 20 years. SIC (Standard Industry Classification) 92 although providing better scope for analysis of the service economy and the information economy in general, still seems more geared towards supplying data on sectors that have declined in importance. Similarly SOC (Standard Occupational Classification) 90 does not allow for in-depth analysis of trends in IT related occupations. It is hoped that the 2000 revision of SOC will present an opportunity to rectify some of these shortcomings.

In terms of more specific IT skills assessment, any framework of analysis must provide information on *competencies and aptitudes* rather than expertise in a particular software package or language. While many businesses are keen to focus on the latter, it is clearly better to focus on the skills that will enable workers to adapt to new technologies and standards as required. Clearly, the pioneering work by the ITNTO to produce a standard framework for assessing IT competencies and occupations, should be encouraged, especially if such standards are clear and easy to follow - at present there is a confusing array of classifications.

6.3 From Data Collection To Policy Development

The path between the creation of better data and policy must be through an analysis of markets and the role that different training providers have in providing products (i.e. skills) to these markets. A key issue here, are the respective roles of the public and private sectors. For different levels of IT skills' provision, policy evolution should be

based on assessment of 'Who is the provider of choice?' for particular businesses and 'Why?'. For example, many companies prefer to use private sector suppliers because they assume or believe that they have better quality staff and are more likely to be at the 'cutting edge'. In this context, even if the public sector were to offer similar courses at the same or lower cost, it is still unlikely that businesses would use them as a training provider.[49]

6.4 Predicting Future Demand

Forecasting future IT skills' requirements is difficult, especially given the rapid speed of technological change. This must also be placed in the context of both the capacity and responsiveness of the training infrastructure. In terms of technical skills related to a particular product or application, this is especially important, as is the ability of training providers to be 'up to speed' on the latest developments. It would seem that in this respect, the private sector has the best 'antenna'. It is most sensitive to the market signals for a particular training product and is better able to respond.

However, any attempt to go beyond this and create a comprehensive strategy based on forecasts of product specific skills is not worth the time or effort, and will ultimately be of little use or even damaging if such a strategy delivers skills for yesterday's product. For example, development of websites used to typically require knowledge of HTML (Hyper Text Markup Language), however the introduction of 'Microsoft Front Page' now enables people without HTML skills to develop websites. This is indicative of how quickly the demand for a particular skill can change as new products are introduced. This also raises issues as to the dominant skills sets for particular job titles. For many web-site designers, artistic and creative flair, has become increasingly important as opposed to knowledge of a particular programming language.

Getting close to technology innovators has been suggested as one way of developing insights into future trends. Clearly in a rapidly changing sector such as IT, the ability to be in-tune with recent developments or to be at 'the cutting-edge' is beneficial. However, such a strategy could be damaging if it reinforces or creates monopolies by supporting the standards or products of a particular supplier to the detriment of market competition. Furthermore, identifying future 'winners' remains problematic, especially given that the key determinant for success is typically having a *standard* that becomes widely accepted rather than necessarily possessing the best technology.

Improving understanding of key trends, getting closer to technology developers and increasing information flows to providers of skills training are all elements of an effective policy response to IT skills issues. However, in this sector perhaps more than any other, notions of directive manpower planning should be treated with caution. The best solutions will involve analysis of need and appropriate response to that need, taking place within respective training markets. Markets should be based on expertise and understanding of competitive advantage within specific niches. Thus, for example, suppliers and private providers responding quickly and efficiently

[49] Similarly, Microsoft approves systems for the delivery of training for its products, but does not use the FE sector.

to demands for product specific skills, whilst the education institutions continue to provide individuals with fundamental IT skills and conceptual frameworks on which they can graft specific IT product skills throughout their working lives. However, these IT product skills should still be placed in the context of the application and business needs. Quick, shallow product training, is just that - it adds little to the total IT skills resource.

6.5 Core Skills Remain Core Skills

While technical, product specific capabilities are clearly important, a key attribute is flexibility - the aptitudes and abilities that enable people to learn new skills. This requires a knowledge of the fundamentals, whether it be in programming or, for example, project management. These attributes are likely to be engendered over a long training period and will not necessarily be specific to the IT sector. Moreover, basic core abilities such as communication, literacy, numeracy and interpersonal skills remain paramount. Evidence of communication problems between IT professionals and business managers or end-users,[50] suggests that considerable improvements to business performance could be delivered by focusing on this area. In this respect, there is a need for IT professionals who can communicate with end-users and who can work to integrate IT more successfully into business strategy.

These skill requirements reinforce the need for an holistic approach to education and training. IT is penetrating ever more sectors of economy and many of the separations between sectors that exist in official statistics do not exist in reality. This fluidity and convergence of sectors, heightens the need to develop skills' sets that are widely applicable and will retain their relevance. The key role of the public sector here, is to develop the core set of skills that provide a solid foundation for future development.

6.6 Delivering IT Skills To Small Businesses

Special attention should be paid to the needs of SMEs. Many small businesses require basic skills and simple IT solutions that match their needs. Given that high costs are usually cited as the reason for SMEs not mastering or developing IT skills, training programmes and support must be affordable for the target market (either via low cost provision or possible subsidies).

Increasingly, university IT graduates can no longer expect to be employed in large companies with graduate training programmes. Many SMEs want graduates who are job ready, have good practical and business skills and are up to date with the latest systems. However, SMEs are frequently unable to articulate their specific skills requirements and unable to invest significantly in training. Efforts such as the HEBP Initiative have proved in many cases to provide an ideal opportunity for graduates to access employment in SMEs and for the SME to take on-board and develop a graduate so that both sets of requirements are met.

[50] Focus Central London, 'City Skills Audit - Information Technology and its uses', 1998. Also Warwick Business School, 'The Information Challenge - Making Your IT Investment Pay Off', 1996.

Focusing on training markets within the SME sector offers the best chance of deploying limited resources to successfully 'add value'. It is an area where existing provision of training and IT support is least developed and where there is considerable unmet demand for basic IT related skills.

KEY POINTS

- Improvements must be made to the quality of IT labour market data. Consistent definition of IT professionals and accounting of these within SOC codes is essential if future assessments of supply and demand are to be more robust.
- In particular, a framework for assessing IT competencies and roles needs to be established - one that is easily understood and can cope with the dynamic pace of change within the Information Economy.
- The rapid pace of change across the IT sector means that the most important skills are those which confer flexibility: i.e. basic aptitudes and a knowledge of IT fundamentals.
- Trying to predict demand for *product specific* skills is extremely difficult. The public sector does not have the resources or the responsiveness to react to ever changing demands for specialists in particular products, nor should it aim to.
- The key role for the education sector is to provide a solid underpinning in the fundamentals of IT, allied to more general skills such as communication, literacy, numeracy, business and project management.
- Public sector provision of IT skills should target areas where it can best make a successful contribution. There must be a proper understanding of market segments and the role of different training and service suppliers. This must acknowledge which organisations are the training provider of choice for which types of businesses.
- SMEs face several basic IT problems that could be the focus for policy development.